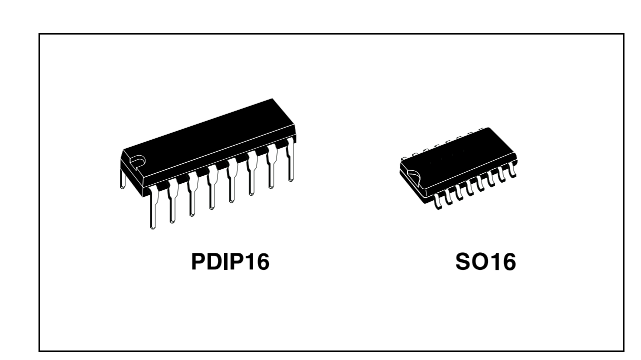


HCF4060

14-stage ripple carry binary counter/divider and oscillator

Datasheet - production data



Features

- Medium speed operation
- Common reset
- Fully static operation
- Buffered inputs and outputs
- Quiescent current specified up to 20 V
- 5 V, 10 V and 15 V parametric ratings
- Input leakage current: I_I = 100 nA (max.) at V_{DD} = 18 V, T_A = 25 °C
- 100% tested for quiescent current
- ESD performance
  - HBM: 1 kV
  - MM: 200 V
  - CDM: 1 kV

Applications

- Automotive
- Industrial
- Computer
- Consumer

Description

The HCF4060 device is a monolithic integrated circuit fabricated in MOS (metal oxide semiconductor) technology available in SO16 and PDIP16 packages.

The HCF4060 device consists of an oscillator section and 14 ripple carry binary counter stages.

The oscillator configuration allows design of either RC or crystal oscillator circuits. A RESET input is provided which resets the counter to the all 0's state and disables the oscillator. A high level on the RESET line accomplishes the reset function. All counter stages are master slave flip-flops. The state of the counter is advanced one step in binary order on the negative transition of ϕ_1 (and ϕ_0). All inputs and outputs are fully buffered. Schmitt trigger action on the clock pin permits unlimited clock rise and fall time.

Table 1. Device summary

Order code	Temperature range	Package	Packaging	Marking
HCF4060M013TR	-55/+125 °C	SO16	Tape and reel	HCF4060
HCF4060YM013TR(1)	-40/+125 °C	SO16 (automotive version)	Tape and reel	HCF4060Y
HCF4060BEY	-55/+125 °C	PDIP16	Tube	HCF4066BE

1. Qualification and characterization according to AEC Q100 and Q003 or equivalent, advanced screening according to AEC Q001 and Q002 or equivalent.

Contents

1 **Pin information** 3

2 **Functional description** 4

3 **Electrical characteristics** 6

4 **Package information** 11

4.1 PDIP16 (0.25) package information 12

4.2 SO16 package information 13

5 **Ordering information** 14

6 **Revision history** 14

1 Pin information

Figure 1. Pin connection

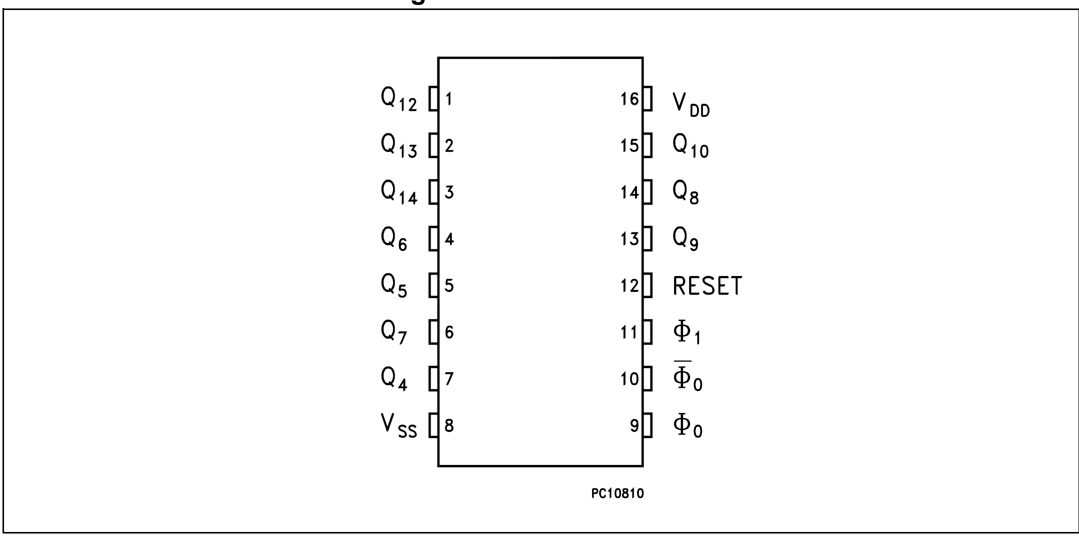


Table 2. Pin description

Pin no.	Symbol	Name and function
1, 2, 3 ,4, 5, 6, 7, 13, 14, 15	Q_{12}, Q_{13}, Q_{14}, Q_6, Q_5, Q_7, Q_4, Q_9, Q_8, Q_{10}	Outputs
9, 10, 11	Φ_0, $\overline{\Phi}_0$, Φ_1	Oscillator input
12	RESET	Reset
8	V_{SS}	Negative supply voltage
16	V_{DD}	Positive supply voltage

2 Functional description

Figure 2. Logic diagram

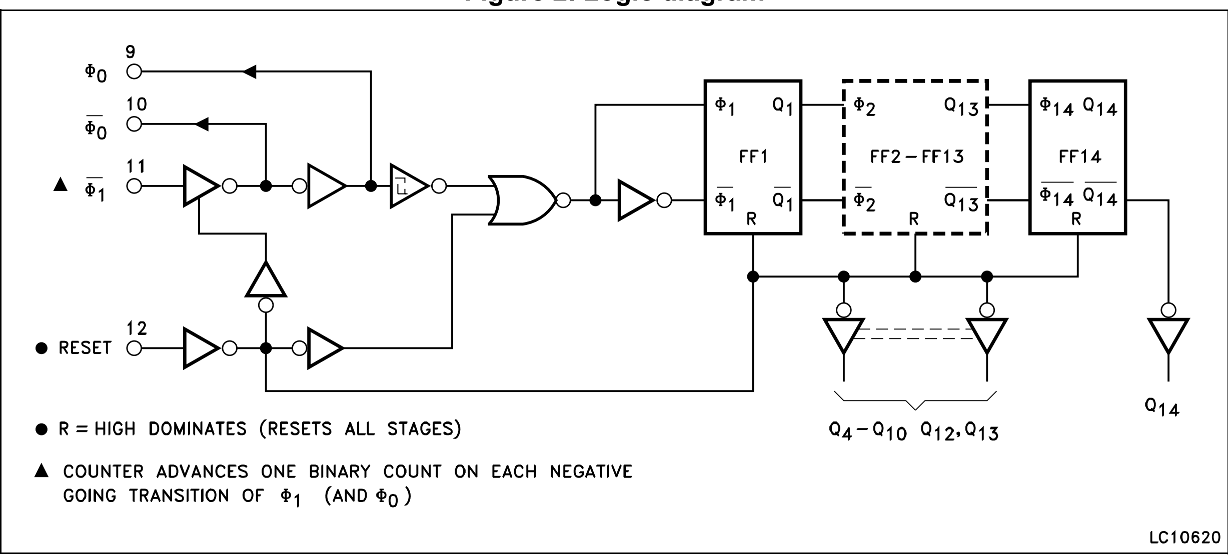


Figure 3. Functional diagram

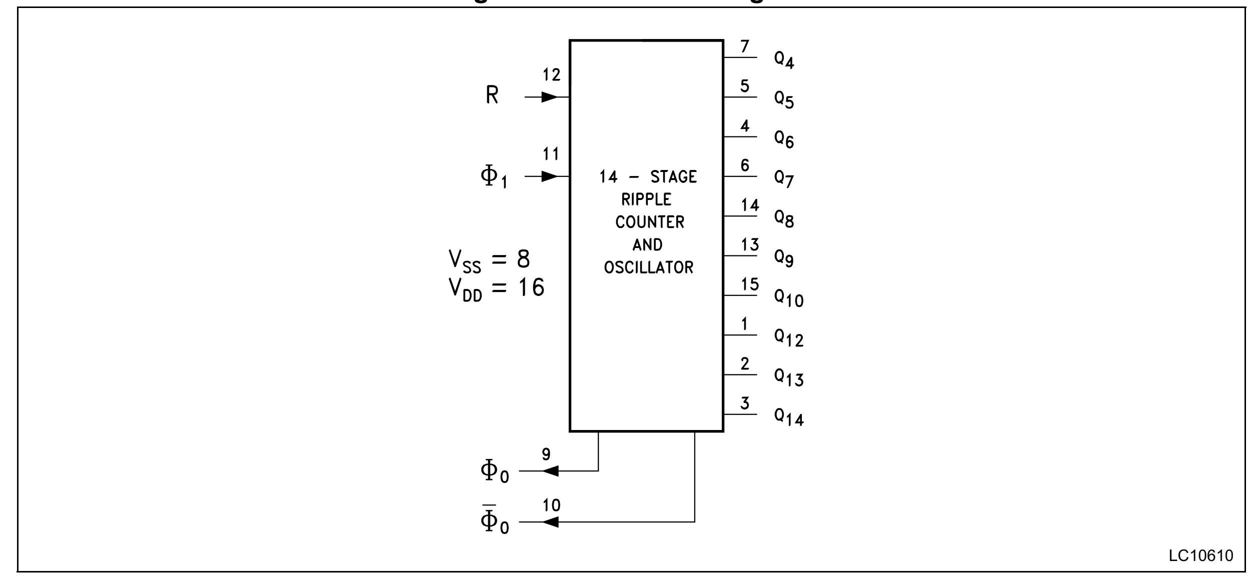


Figure 4. Input equivalent circuit

V_{DD}
INPUT
V_{SS}
CS03790

3 Electrical characteristics

Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. All voltage values are referred to V_{SS} pin voltage.

Table 3. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DD}	Supply voltage	-0.5 to +22	V
V_I	DC input voltage	-0.5 to V_{DD} + 0.5	
I_I	DC input current	±10	mA
P_D	Power dissipation per package	200	mW
	Power dissipation per output transistor	100	
T_{op}	Operating temperature	-55 to +125	°C
T_{stg}	Storage temperature	-65 to +150	

Table 4. Recommended operating conditions

Symbol	Parameter	Value	Unit
V_{DD}	Supply voltage	3 to 20	V
V_I	Input voltage	0 to V_{DD}	
T_{op}	Operating temperature	-55 to 125	°C

Table 5. DC specifications(1)

Symbol	Parameter	Test condition				Value							Unit
		V_I (V)	V_O (V)	$\|I_O\|$ (µA)	V_{DD} (V)	T_A = 25 °C			-40 to 85 °C		-55 to 125 °C		
						Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
I_L	Quiescent current	0/5			5		0.04	5		5		150	µA
		0/10			10		0.04	10		10		300	
		0/15			15		0.04	20		20		600	
		0/20			20		0.08	100		100		3000	
V_{OH}	High level output voltage	0/5		<1	5	4.95			4.95		4.95		V
		0/10		<1	10	9.95			9.95		9.95		
		0/15		<1	15	14.95			14.95		14.95		
V_{OL}	Low level output voltage	5/0		<1	5		0.05			0.05		0.05	
		10/0		<1	10		0.05			0.05		0.05	
		15/0		<1	15		0.05			0.05		0.05	
V_{IH}	High level input voltage		0.5/4.5	<1	5	3.5			3.5		3.5		
			1/9	<1	10	7			7		7		
			1.5/13.5	<1	15	11			11		11		
V_{IL}	Low level input voltage		4.5/0.5	<1	5			1.5		1.5		1.5	
			9/1	<1	10			3		3		3	
			13.5/1.5	<1	15			4		4		4	
I_{OH}	Output drive current	0/5	2.5	<1	5	-1.36	-3.2		-1.15		-1.1		mA
		0/5	4.6	<1	5	-0.44	-1		-0.36		-0.36		
		0/10	9.5	<1	10	-1.1	-2.6		-0.9		-0.9		
		0/15	13.5	<1	15	-3.0	-6.8		-2.4		-2.4		
I_{OL}	Output sink current	0/5	0.4	<1	5	0.44	1		0.36		0.36		
		0/10	0.5	<1	10	1.1	2.6		0.9		0.9		
		0/15	1.5	<1	15	3.0	6.8		2.4		2.4		
I_I	Input leakage current	0/18	Any input		18		$\pm10^{-5}$	±0.3		±0.3		±1	µA
C_I	Input capacitance		Any input				5	7.5					pF

1. The noise margin for both “1” and “0” level is: 1 V min. with V_{DD} = 5 V, 2 V min. with V_{DD} = 10 V, 2.5 V min. with V_{DD} = 15 V.

Table 6. Dynamic electrical characteristics
(T_{amb} = 25 °C, C_L = 50 pF, R_L = 200 KΩ, t_r = t_f = 20 ns)

Symbol	Parameter	Test condition		Value(1)			Unit
		V_{DD} (V)		Min.	Typ.	Max.	
t_{TLH}, t_{THL}	Output transition time	5			100	200	ns
		10			50	100	
		15			40	80	
t_{PLH}, t_{PHL}	Propagation delay time (ϕ to Q_4 out)	5			370	740	
		10			150	300	
		15			100	200	
t_{PLH}, t_{PHL}	Propagation delay time (Q_n to Q_{n+1})	5			100	200	
		10			50	100	
		15			40	80	
t_W	Input pulse width	5	f = 100 KHz		50	100	
		10			20	40	
		15			15	30	
t_r, t_f	Input pulse rise and fall time	5		Unlimited			µs
		10					
		15					
f_{max}	Maximum clock input frequency	5		3.5	7		MHz
		10		8	16		
		15		12	24		
Reset operation							
t_{PHL}	Propagation delay time	5			180	360	ns
		10			80	160	
		15			50	100	
t_W	Input pulse width	5			60	120	
		10			30	60	
		15			20	40	
RC operation							
	Variation of frequency (unit-to-unit)	5	C_x = 200 pF, R_s = 560 KΩ, R_x = 50 KΩ	18	21.5	25	KHz
		10		20	23	26	
		15		21.1	24	27	
	Variation of frequency with voltage change (the same unit)	5 to 10	C_x= 200 pF, R_s = 560 KΩ, R_x = 50 KΩ			2	
		10 to 15				1	

Table 6. Dynamic electrical characteristics (T_{amb} = 25 °C, C_L = 50 pF, R_L = 200 KΩ, $t_r = t_f$ = 20 ns) (continued)

Symbol	Parameter	Test condition		Value[1]			Unit
		V_{DD} (V)		Min.	Typ.	Max.	
R_X		5	C_x = 10 µF			20	MΩ
		10	C_x = 50 µF			20	
		15	C_x = 10 µF			10	
C_X		5	R_x = 500 KΩ			1000	µF
		10	R_x = 300 KΩ			50	
		15	R_x = 300 KΩ			50	
	Maximum oscillator frequency[2]	10	R_x = 5 KΩ, C_x = 15 pF	530	650	810	pF
		15		690	800	940	

1. Typical temperature coefficient for all V_{DD} values is 0.3 %/°C, all input rise and fall times = 20 ns.
2. RC oscillator applications are not recommended at supply voltages below 7 V for R_X = 50 KΩ.

Figure 5. Detail of typical flip-flop stage

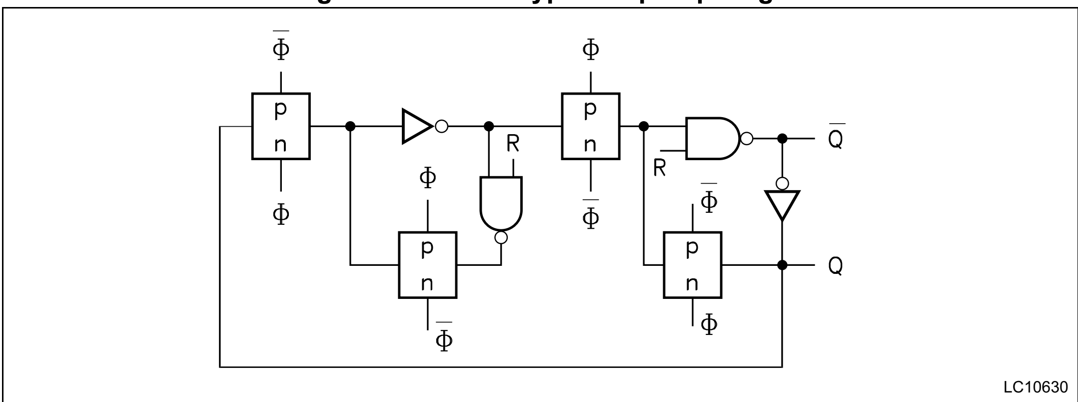


Figure 6. Typical RC oscillator circuit

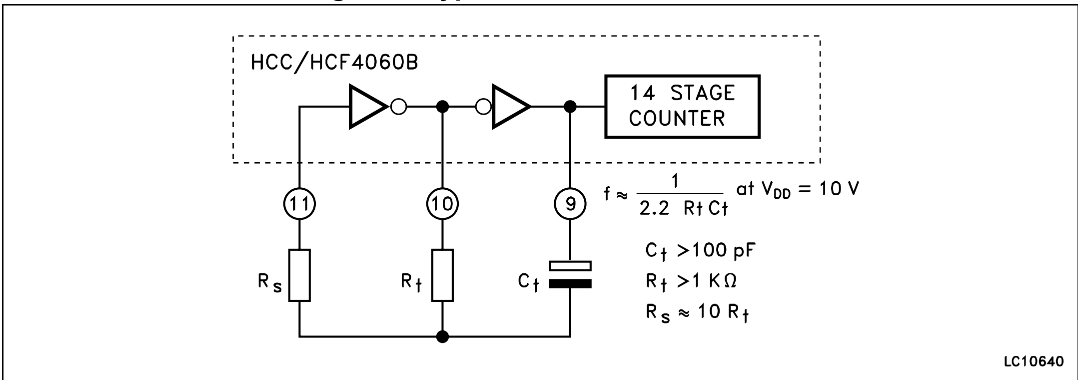
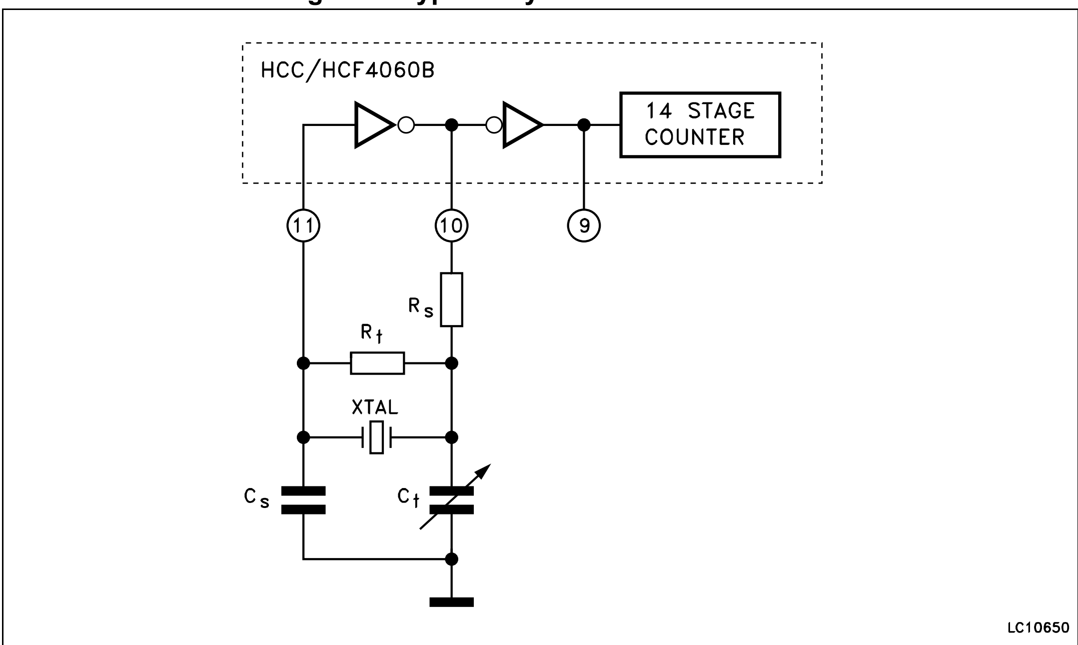


Figure 7. Typical crystal oscillator circuit



4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: *www.st.com*. ECOPACK is an ST trademark.

4.1 PDIP16 (0.25) package information

Figure 8. PDIP16 (0.25) package mechanical drawing

Table 7. PDIP16 (0.25) package mechanical data

Symbol	Dimensions					
	mm			inch		
	Min.	Typ.	Max.	Min.	Typ.	Max.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050

4.2 SO16 package information

Figure 9. SO16 package mechanical drawing

Table 8. SO16 package mechanical data

Symbol	Dimensions					
	mm			inch		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.068
a1	0.1		0.2	0.004		0.008
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.62			0.024
S	8 ° (max.)					

5 Ordering information

Table 9. Order codes

Order code	Temperature range	Package	Packaging	Marking
HCF4060M013TR	-55/+125 °C	SO16	Tape and reel	HCF4060
HCF4060YM013TR(1)	-40/+125 °C	SO16 (automotive version)		HCF4060Y
HCF4060BEY	-55/+125 °C	PDIP16	Tube	HCF4066BE

1. Qualification and characterization according to AEC Q100 and Q003 or equivalent, advanced screening according to AEC Q001 and Q002 or equivalent.

6 Revision history

Table 10. Document revision history

Date	Revision	Changes
29-Oct-2012	5	Updated *Features* (added ESD values), added *Applications*. Updated *Table 1* (reformatted table, added order codes, temperature range, marking, updated package and packaging, added note *1.*). Moved *Description* to page 2, updated *Description* (unified part numbers and package names). Updated *Section 2* to *Section 4* (added titles and numbering). Reformatted *Section 4* (added ECOPACK text, *Figure 8*, *Figure 9*, *Table 7* and *Table 8*, unified package names). Minor corrections throughout document.
02-May-2013	6	Updated *Features* (ESD values) Added *Ordering information*

